

What is claimed is:

- 5 1. An asphalt-based roofing material comprising:
a mat saturated and coated with an asphalt-based coating, the coating
including a top portion covering the top of the mat, a mat portion saturating the
mat, and a bottom portion covering the bottom of the mat;
wherein the top portion of the coating comprises a mixture of asphalt and
rock particles selected from the group consisting of igneous rock particles,
metamorphic rock particles, and mixtures thereof; and
wherein the mat portion of the coating comprises a mixture of asphalt and
10 filler, the filler containing no more than about 10% rock particles selected from
the group consisting of igneous rock particles, metamorphic rock particles, and
mixtures thereof, by weight of the filler.
- 15 2. A roofing material according to claim 1 wherein the filler in the
mat portion of the coating comprises rock particles.
3. A roofing material according to claim 2 wherein the rock particles
comprise sedimentary rock particles.
- 20 4. A roofing material according to claim 1 wherein the filler in the top
portion of the coating comprises trap rock particles, and the filler in the mat
portion of the coating comprises limestone particles.
- 25 5. A roofing material according to claim 1 wherein the bottom portion
of the coating comprises a mixture of asphalt and filler, the filler containing no
more than about 10% rock particles selected from the group consisting of
igneous rock particles, metamorphic rock particles, and mixtures thereof, by
weight of the filler.

6. An asphalt-based roofing material comprising:
a mat saturated and coated with an asphalt-based coating, the coating
including a top portion covering the top of the mat, a mat portion saturating the
mat, and a bottom portion covering the bottom of the mat;

5 wherein the top portion of the coating meets or exceeds a pliability
standard described in CSA Standard A123.5-98; and

wherein the bottom portion of the coating does not meet the pliability
standard.

10 7. A roofing material according to claim 6 wherein the top portion of
the coating is made with a ferric treated asphalt.

8. An asphalt-based roofing material comprising:
a mat saturated and coated with an asphalt-based coating, the coating
15 including a top portion covering the top of the mat, a mat portion saturating the
mat, and a bottom portion covering the bottom of the mat, the top portion of the
coating including a top surface layer;

20 wherein at least the top surface layer of the top portion passes a
weathering performance test as measured by at least 60 cycles-to-failure using
ASTM Method D4799; and

wherein the bottom portion of the coating does not pass the weathering
performance test.

25 9. A roofing material according to claim 8 wherein the top surface
layer is at least about 0.023 inch (0.058 cm) thick.

10. A roofing material according to claim 8 wherein the entire top
portion of the coating passes the weathering performance test.

11. An asphalt-based roofing material comprising:
a mat saturated and coated with an asphalt-based coating, the coating
including a top portion covering the top of the mat, a mat portion saturating the
mat, and a bottom portion covering the bottom of the mat, the top portion of the
5 coating including a top surface layer;

wherein at least the top surface layer of the top portion has a solar
reflectance of at least 0.7 when tested by ASTM Method E903; and

wherein the bottom portion of the coating has a solar reflectance of less
than 0.7.

12. A laminated asphalt-based roofing material comprising:
an underlay comprising a mat saturated and coated with an asphalt-based
coating, the coating including a top portion covering the top of the mat, a mat
portion saturating the mat, and a bottom portion covering the bottom of the mat,
15 the top portion of the coating including a top surface layer; and

an overlay covering a portion of the top of the underlay, and leaving a
portion of the underlay uncovered, the overlay comprising a layer of an asphalt-
based coating, the coating layer including a top surface layer;

wherein at least the top surface layer of the overlay, and at least the top
20 surface layer of the underlay on the uncovered portion of the underlay, are made
with an asphalt having viscoelastic properties effective to prevent the coating
from sticking to a coating of an adjacent shingle when the shingles are stacked
face to face in a bundle and stored at a temperature exceeding 90°F (32°C); and

wherein the bottom portion of the underlay coating is made with an
25 asphalt not having the viscoelastic properties.

13. A laminated roofing material according to claim 12 wherein the top surface layer of the overlay, and the top surface layer of the underlay on the uncovered portion of the underlay, are at least about 0.023 inch (0.058 cm) thick.

5 14. A laminated roofing material according to claim 12 wherein the entire top portion of the coating on the uncovered portion of the underlay is made with an asphalt having the viscoelastic properties.

10 15. A laminated roofing material according to claim 12 wherein the overlay further comprises a mat saturated and coated with the layer of asphalt-based coating, the coating including a top portion covering the top of the mat, a mat portion saturating the mat, and a bottom portion covering the bottom of the mat, and wherein the entire top portion of the coating is made with an asphalt having the viscoelastic properties, and the bottom portion of the coating is made
15 with an asphalt not having the viscoelastic properties.

16. An asphalt-based roofing material comprising:
a mat saturated and coated with an asphalt-based coating, the coating including a top portion covering the top of the mat, a mat portion saturating the
20 mat, and a bottom portion covering the bottom of the mat, the top portion of the coating including a top surface layer, and a layer of granules embedded in the top surface layer;

wherein at least the top surface layer of the top portion has an increased adhesion defined by a granule loss of less than 0.8 grams when the roofing
25 material is soaked in water for seven days and then tested by ASTM Method D4977; and

wherein the bottom portion of the coating does not have the increased adhesion.

17. An asphalt-based roofing material comprising:
a mat saturated and coated with an asphalt-based coating, the coating
including a top portion covering the top of the mat, a mat portion saturating the
mat, and a bottom portion covering the bottom of the mat;

5 wherein the bottom portion of the coating has an increased toughness
compared to the top portion of the coating, such that the roofing material has an
increased impact resistance of at least one UL 2218 class compared to the same
roofing material having a bottom portion of the coating with the same toughness
as the top portion.

10 18. A roofing material according to claim 17 wherein the roofing
material has an increased impact resistance of at least two UL 2218 classes.

15 19. A roofing material according to claim 17 wherein the roofing
material meets a UL 2218 Class 4 impact resistance standard.

20 20. An asphalt-based roofing material comprising:
a mat saturated and coated with an asphalt-based coating, the coating
including a top portion covering the top of the mat, a mat portion saturating the
mat, and a bottom portion covering the bottom of the mat, the top portion of the
coating including a top surface layer, and a layer of granules embedded in the top
surface layer;

25 wherein at least the top surface layer of the top portion has an increased
adhesion defined by a granule loss of less than 0.8 grams when the roofing
material is soaked in water for seven days and then tested by ASTM Method
D4977; and

wherein the roofing material further comprises a web fused to the bottom
portion of the coating, the roofing material having an increased impact resistance

of at least one UL 2218 class compared to the same roofing material without the web.

21. A continuous process of applying first and second asphalt-based coatings to a mat for manufacturing a roofing material, the process comprising:
continuously moving a continuous mat along a path, the mat having a first surface and a second surface;

in a first coating operation, continuously applying a first asphalt-based coating to the first surface of the mat in a manner so that the first coating saturates the mat and forms a layer on the first surface; and then

in a second coating operation, continuously applying a second asphalt-based coating to the second surface of the mat in a manner so that the second coating forms a layer on the second surface, the second coating having different properties from the first coating.

22. A process according to claim 21 wherein the first and second coating operations can be independently controlled in a dial-in mode in which control parameters are set once and do not require adjustment throughout the continuous process.

23. A process according to claim 21 wherein the first surface of the mat is a bottom surface, and the first coating operation comprises applying the first coating to the bottom surface of the mat in a manner so that the first coating saturates the mat and forms a layer on the bottom surface.

24. A process according to claim 23 wherein the mat is inverted before the first coating operation so that the bottom surface is oriented upward when applying the first coating.

25. A process according to claim 24 wherein the first coating operation comprises moving the mat through a gap between an upper squeeze roll and a lower squeeze roll, and supplying the first coating to a location before the gap and above the mat so that the first coating moves through the gap with the mat, the squeeze rolls forcing the first coating to enter and saturate the mat and to form a layer on the bottom surface of the mat.

26. A process according to claim 25 wherein the upper squeeze roll rotates in a direction so that the surface of the upper squeeze roll adjacent the mat moves in a direction opposite the direction of the mat.

27. A process according to claim 26 wherein the lower squeeze roll rotates in a direction so that the surface of the lower squeeze roll adjacent the mat moves in the same direction as the mat.

28. A process according to claim 26 wherein the size of the gap between the upper squeeze roll and the lower squeeze roll controls the thickness of the layer of first coating on the mat.

29. A process according to claim 23 wherein the bottom surface is oriented downward when applying the first coating to the bottom surface.

30. A process according to claim 29 wherein the first coating operation comprises moving the mat through a gap between an upper squeeze roll and a lower squeeze roll, and supplying the first coating to a location before the gap and below the mat so that the first coating moves through the gap with the mat,

the squeeze rolls forcing the first coating to enter and saturate the mat and to form a layer on the bottom surface of the mat.

5 31. A process according to claim 30 wherein the lower squeeze roll rotates in a direction so that the surface of the lower squeeze roll adjacent the mat moves in a direction opposite the direction of the mat.

10 32. A process according to claim 31 wherein the position of the mat is controlled so that the mat does not wrap on the lower squeeze roll.

33. A process according to claim 31 wherein the upper squeeze roll rotates in a direction so that the surface of the upper squeeze roll adjacent the mat moves in the same direction as the mat.

15 34. A process according to claim 30 wherein the size of the gap between the upper squeeze roll and the lower squeeze roll controls the thickness of the layer of first coating on the mat.

20 35. A process according to claim 30 wherein the first coating is supplied by applying a layer of the first coating to the bottom surface of the mat before moving the mat through the squeeze rolls.

25 36. A process according to claim 35 wherein the first coating is supplied by applying the layer of first coating to the bottom surface of the mat with an inking roll.

37. A process according to claim 30 wherein the first coating is supplied by feeding the first coating to a nip between the mat and the lower squeeze roll.

5 38. A process according to claim 37 wherein the first coating is fed to the nip via a trough which seals against the lower squeeze roll.

10 39. A process according to claim 21 wherein the second coating is applied with an applicator roll, and including the step of scraping the second coating from the surface of the applicator roll and smoothly apply the scraped coating to the mat.

15 40. A process according to claim 21 wherein the second coating is applied with an applicator roll, and wherein the second coating operation further employs a metering roll positioned adjacent the applicator roll with a gap therebetween, the size of the gap controlling the thickness of the second coating on the mat.

20 41 A process according to claim 40 wherein the applicator roll rotates in a direction so that the surface of the applicator roll adjacent the mat moves in the same direction as the mat.

25 42. A process according to claim 41 wherein the surface of the applicator roll adjacent the mat moves at a speed within a range of from about 70% to about 130% of the speed of the mat.

43. A process according to claim 41 wherein the surface of the applicator roll adjacent the mat moves at a speed within a range of from about 90% to about 110% of the speed of the mat.

5 44. A process according to claim 21 wherein the second coating is applied with an applicator roll, and wherein the mat at least slightly wraps on the applicator roll to promote wetting and transfer of the second coating to the mat.

10 45. A process according to claim 44 wherein the mat wraps on the applicator roll over at least about 120 degrees of the applicator roll.

15 46. A process according to claim 40 wherein the applicator roll rotates in a direction so that the surface of the applicator roll adjacent the mat moves in the a direction which is reverse the direction of the mat, and wherein the surface of the applicator roll adjacent the mat moves at a speed within a range of from about 10% to about 100% of the speed of the mat.

20 47. A process according to claim 40 wherein the applicator roll rotates in a direction so that the surface of the applicator roll adjacent the mat moves in the a direction which is reverse the direction of the mat, and wherein the surface of the applicator roll adjacent the mat moves at a speed within a range of from about 20% to about 60% of the speed of the mat.

25 48. A process according to claim 40 wherein the applicator roll rotates in a direction so that the surface of the applicator roll adjacent the mat moves in the a direction which is reverse the direction of the mat, and wherein the surface of the applicator roll adjacent the mat moves at a speed within a range of from about 30% to about 50% of the speed of the mat.

FOOTNOTES: 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

49. A continuous process of applying first and second asphalt-based coatings to a mat for manufacturing a roofing material, the process comprising:
continuously moving a continuous mat along a path, the mat having a
5 bottom surface and a top surface;

in a first coating operation, continuously applying a first asphalt-based coating to the bottom surface of the mat in a manner so that the first coating saturates the mat and forms a layer on the bottom surface; and then

in a second coating operation, continuously applying a second asphalt-based coating to the top surface of the mat in a manner so that the second coating forms a layer on the top surface, the second coating having different properties from the first coating;

wherein the first and second coating operations can be independently controlled in a dial-in mode in which control parameters are set once and do not
15 require adjustment throughout the continuous process.

50. A continuous process of applying first and second asphalt-based coatings to a mat for manufacturing a roofing material, the process comprising:
continuously moving a continuous mat along a path, the mat having a
20 bottom surface and a top surface;

inverting the mat before a first coating operation so that the bottom surface is oriented upward when applying a first asphalt-based coating to the bottom surface;

in the first coating operation, continuously applying the first coating to the
25 bottom surface of the mat in a manner so that the first coating saturates the mat and forms a layer on the bottom surface, wherein the first coating operation comprises moving the mat through a gap between an upper squeeze roll and a lower squeeze roll, and supplying the first coating to a location before the gap

and above the mat so that the first coating moves through the gap with the mat, the squeeze rolls forcing the first coating to enter and saturate the mat and to form the layer on the bottom surface; and then

in a second coating operation, continuously applying a second asphalt-based coating to the top surface of the mat in a manner so that the second coating forms a layer on the top surface, the second coating having different properties from the first coating, wherein the second coating is applied with an applicator roll, and including the step of scraping the second coating from the surface of the applicator roll and smoothly applying the scraped coating to the mat.

51. A continuous process of applying first and second asphalt-based coatings to a mat for manufacturing a roofing material, the process comprising:

continuously moving a continuous mat along a path, the mat having a first surface and a second surface;

in a first coating operation, continuously applying a first asphalt-based coating to the first surface of the mat in a manner so that the first coating saturates the mat and forms a layer on the first surface; and then

in a second coating operation, continuously applying a second asphalt-based coating to the second surface of the mat with an applicator roll in a manner so that the second coating forms a layer on the second surface, and including the step of scraping the second coating from the surface of the applicator roll and smoothly applying the scraped coating to the mat.

52. A coating apparatus for applying first and second asphalt-based coatings to a mat for manufacturing a roofing material, the apparatus comprising:

a pair of squeeze rolls for continuously applying a first asphalt-based coating to a first surface of the mat in a manner so that the first coating saturates the mat and forms a layer on the first surface;

an applicator roll for continuously applying a second asphalt-based coating to a second surface of the mat in a manner so that the second coating forms a layer on the second surface;

5 a metering device positioned adjacent the applicator roll with a gap therebetween, the size of the gap determining the thickness of the layer of second coating; and

a scraping device for scraping the second coating from the surface of the applicator roll and smoothly applying the scraped coating to the mat.